

APPENDIX II

LOW PRESSURE SPRINKLER IRRIGATION ALTERNATIVES

The purpose of this appendix is to provide guidance in the selection of low pressure alternatives on both center pivot and sideroll sprinklers.

With high interest rates and high fuel costs pressing in on producers, everyone has been looking at ways to lower farming costs and increase net profits. With sprinkler irrigation, the recent buzz word seems to be "low pressure." Low pressure equipment includes spray nozzles, pressure regulators, flow regulators, low angle nozzles, and noncircular orifice nozzles.

Most advertisements and equipment on the market today claim that lowering the sprinkler pressure will decrease pumping costs and increase net profits; however, tests conducted by the Soil Conservation Service in New Mexico and West Texas reveal that this claim is not always correct.

The following tests and discussion are presented in an effort to clarify the role that pressure reduction plays in the overall pumping cost picture.

PUMPING COSTS

The pumping cost of any irrigation pumping plant depends directly on the pump load and the total pumping time.

The total time a pump is run depends on three main items: how much water is needed, the efficiency of the operator's water management, and the efficiency of the sprinkler hardware.

The load or horsepower on the pumping plant is governed by the pumping plant's efficiency, the gallons per minute pumped, and the total head on the pump.

The sprinkler pressure and the well lift both combine to make the total pumping head.

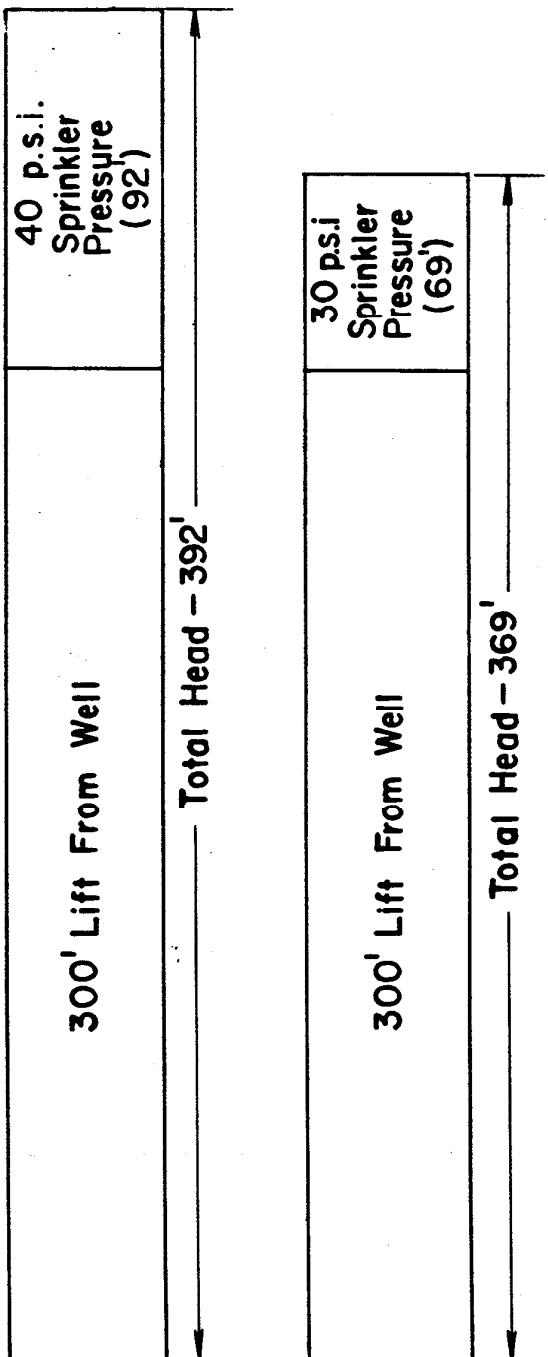
HEAD VS. EFFICIENCY

If we examine the total head on a pumping plant with a 300-foot lift and 40 PSI sprinkler pressure, we see that the well lift of 300 feet combines with the 40 PSI or (92 feet) to produce a total head of 392 feet on the pumping plant (Figure 1).

If the sprinkler pressure on this system is reduced to 30 PSI, the total head on the pumping plant becomes 369 feet. The pumping lift savings is 23 feet, or only 6 percent of the original pumping head. If the pumping head is lowered 6 percent, there must be some maximum numerical decrease in sprinkler system efficiency on the 30 PSI system that could be absorbed, and still have the same pumping cost as the 40 PSI system. Assuming no decreasing yield, this efficiency decrease value has been calculated to be 4 percentage points.

In other words, if the 30 PSI system has a system efficiency of ~~4 percentage~~ points less than the 40 PSI system, then the lower pressure 30 PSI system is not cost-effective.

PUMPING HEAD COMPARISONS FOR VARIOUS SPRINKLER SYSTEMS



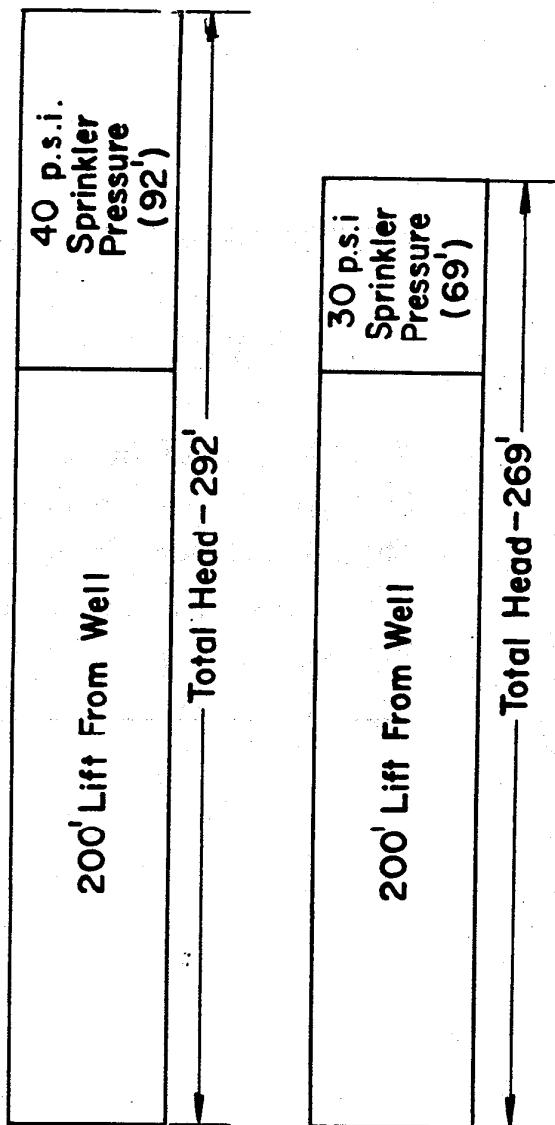
Pumping Head Saved = 23'

$$\frac{23}{392} = 6\%$$

If Efficiency of 30 p.s.i. Sprinkler System is More Than 4% Lower Than 40 p.s.i. System, Then Low Pressure System is not Cost Effective.

FIGURE 1

PUMPING HEAD COMPARISONS FOR VARIOUS SPRINKLER SYSTEMS



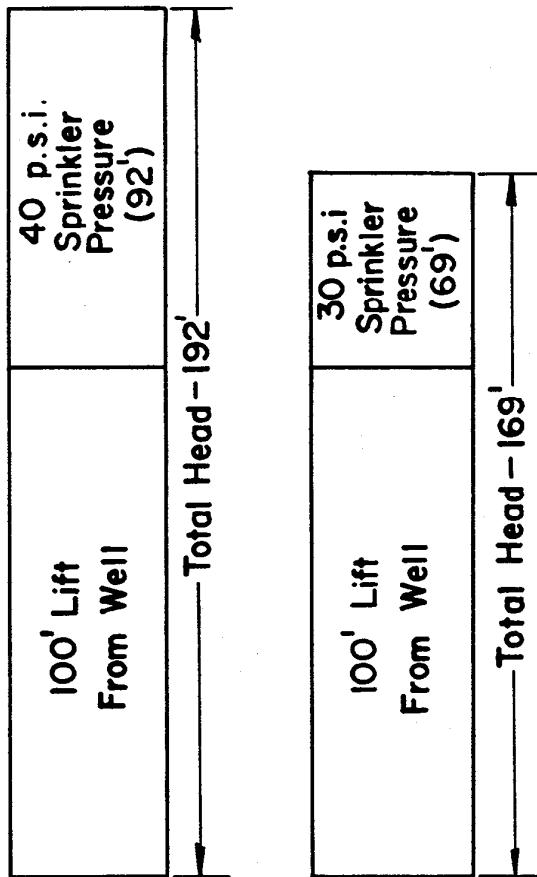
Pumping Head Saved = 23'

$$\frac{23}{292} = 8\%$$

If Efficiency of 30 p.s.i.
Sprinkler System is More
Than 6% Lower Than 40
p.s.i. System, Then Low
Pressure System is not
Cost Effective.

FIGURE 2

PUMPING HEAD COMPARISONS FOR VARIOUS SPRINKLER SYSTEMS



Pumping Head Saved = 23'

$$\frac{23}{192} = 12\%$$

If Efficiency of 30 p.s.i.
Sprinkler System is More
Than 9% Lower Than 40
p.s.i. System, Then Low
Pressure System is not
Cost Effective.

FIGURE 3

BREAK EVEN ANALYSIS FOR REDUCED PRESSURE SPRINKLERS

L = WELL LIFT (FT.)

P₁ = SPRINKLER PRESSURE (P.S.I.) ①

H₁ = L + P₁ (FT.)

P₂ = SPRINKLER PRESSURE (P.S.I.) ②

H₂ = L + P₂ (FT.)

D = MAXIMUM ALLOWABLE DECREASE IN
SPRINKLER SYSTEM EFFICIENCY TO
PRODUCE COST-EFFECTIVE SYSTEM

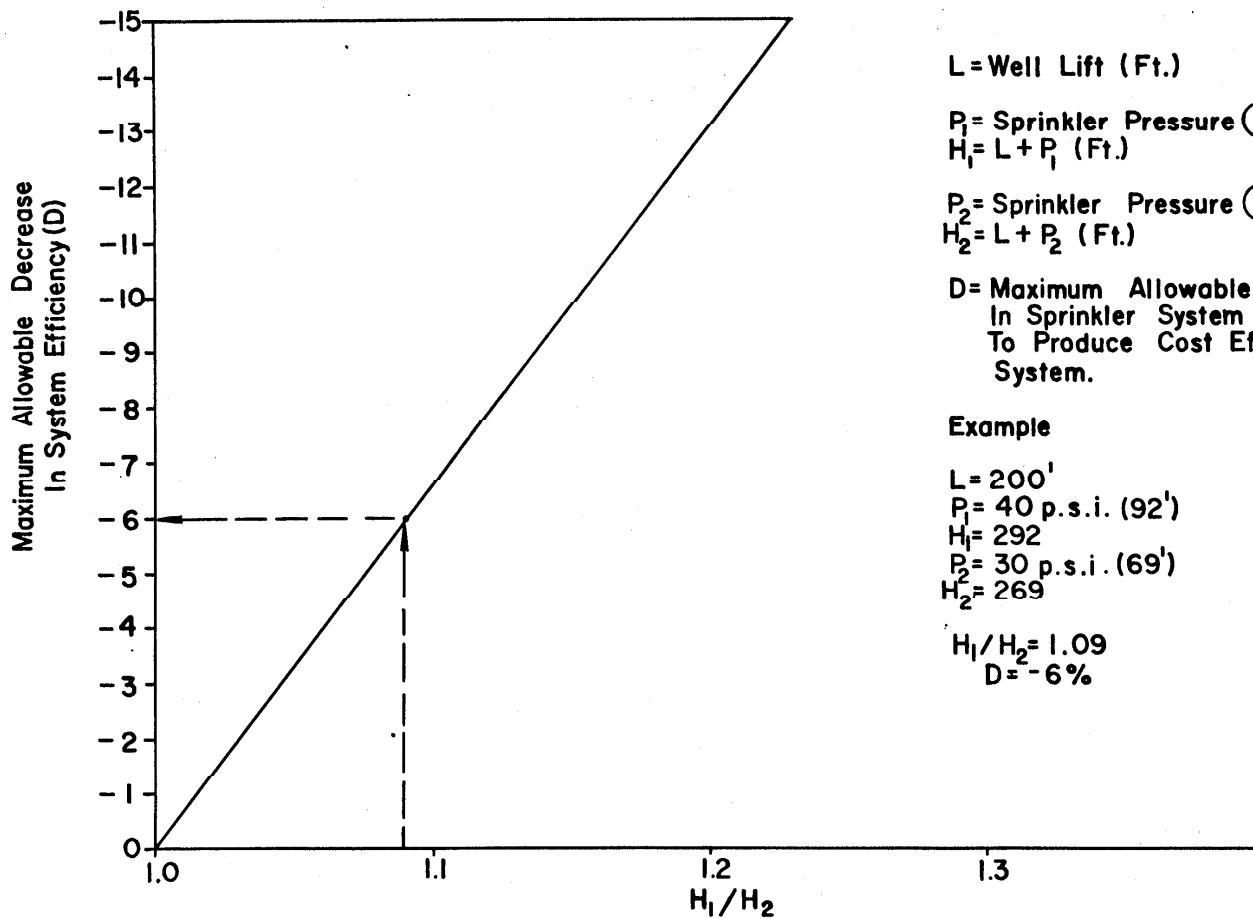
L	P ₁	H ₁	P ₂	H ₂	H ₁ /H ₂	D
300	40	392	30	369	1.06	-4 %
300	40	392	20	346	1.13	-8.5 %
200	40	292	30	269	1.09	-6 %
100	40	192	30	169	1.13	-8.5 %

FIGURE 4

BREAK EVEN ANALYSIS FO. REDUCED PRESSURE SPRINKLERS

Efficiency Decreases Exceeding 15%
Will Limit System Capabilities.

FIGURE 5



L = Well Lift (Ft.)

P_1 = Sprinkler Pressure (1)
 $H_1 = L + P_1$ (Ft.)

P_2 = Sprinkler Pressure (2)
 $H_2 = L + P_2$ (Ft.)

D = Maximum Allowable Decrease
In Sprinkler System Efficiency
To Produce Cost Effective
System.

Example

$L = 200'$
 $P_1 = 40$ p.s.i. (92')
 $H_1 = 292$
 $P_2 = 30$ p.s.i. (69')
 $H_2 = 269$

$$H_1/H_2 = 1.09$$
$$D = -6\%$$

If the pumping lift is 200 feet instead of 300 feet, then the decrease in sprinkler system efficiency that can be absorbed and still be cost-effective becomes 6 percentage points (Figure 2).

If the lift is very shallow, only 100 feet, then lowering the sprinkler pressure from 40 PSI to 30 PSI could absorb a decrease in sprinkler efficiency of 8-1/2 percentage points and still be cost-effective. (Figure 3).

When comparing low- and high-pressure sprinkler operating under the same climatic conditions and lift, Figures 4 and 5 can be used to determine whether or not the low-pressure sprinkler system is cost-effective when compared to its high-pressure counterpart.

WIND

Field evaluations of sprinkler systems in New Mexico note a distinct correlation between wind and sprinkler performance. In the past, many correlations have been made (or attempted) between wind speed (MPH) and sprinkler performance. It has been found in New Mexico, however, that it is not wind speed but the total wind volume (miles per day, MPD) that has a greater effect and correlation on the sprinkler efficiency and performance.

For example, if we look at locations in New Mexico where there are major sprinkler concentrations and good wind records (Figures 6 and 7), we see that the wind volume varies greatly between locations and, in some cases, the wind volume at one location is 10-20 times that of another

WIND ANALYSIS - NEW MEXICO LOCATION - 1980

VALUES SHOWN ARE TOTAL MONTHLY WIND MOVEMENT AT STATION (miles)

FIGURE 6

MONTH	CLOVIS	ESTANCIA	ARTESIA	ROSWELL
APRIL	5945	—	423	1658
MAY	5527	998	454	1698
JUNE	5824	654	421	1902
JULY	4897	466	279	1841
AUGUST	4730	530	256	1612
SEPT.	3801	397	198	1073

WIND ANALYSIS - NEW MEXICO LOCATION - 1981

VALUES SHOWN ARE TOTAL MONTHLY WIND MOVEMENT AT STATION (miles)

MONTH	CLOVIS	ESTANCIA	ARTESIA	ROSWELL
APRIL	6412	—	526	2020
MAY	6615	1129	522	1589
JUNE	5818	746	411	1483
JULY	4647	451	349	1099
AUGUST	3826	309	260	887
SEPT.	3916	269	246	849

FIGURE 7

location. This wind volume explains why a certain sprinkler nozzle may appear to function properly at a location of low wind volume but be a miserable failure at another location of much higher wind volume.

CENTER PIVOT EVALUATIONS

The Soil Conservation Service in New Mexico and Texas has in recent years, evaluated over 300 center pivot sprinkler systems, some of which are shown in the attached tables. From these tests, it was found that low-pressure nozzles do not always produce the most efficient or the most cost-effective system. Systems with a low pattern efficiency, regardless of pivot pressure, are usually not correctly nozzled to the existing flow and pressure conditions of the water source. Of the low-pressure systems evaluated, some came from the manufacturer, nozzled for low pressure, while others were high-pressure systems which had been converted by the landowner to low-pressure nozzles.

As a result of these actual on-farm studies, the following items appear to have the greatest overall effect on center pivot system efficiency and should be carefully considered by any landowner contemplating a new or renozzled center pivot sprinkler:

1. Match the nozzle package to the current output conditions of the irrigation well. Lack of knowledge about the well's current output, under pressure, prior to installation, leads to an erroneous, costly, and inefficient nozzle set. This one item has the greatest effect on the overall performance of a center pivot system.

2. Many existing high-pressure systems which have been converted by the landowner or the installer to low-pressure nozzles have excessive and costly pressure losses in the lateral line due to the small diameter of the lateral pipe size. Existing high-pressure systems with lateral pipe diameter less than 6-1/2 inches usually cannot be effectively converted to low-pressure nozzles. From these evaluations, it also appears that nozzle pressures lower than 10 PSI are not satisfactory for efficient operation of low-pressure spray nozzles.

As an aid to farmers contemplating a renozzling of an existing center pivot system, the SCS in New Mexico has the computer facilities to renozzle any make of center pivot system to any desired pressure and nozzle spacing combination. This program gives the farmer the expected pressure in GPM at each individual nozzle point and custom-fits the nozzle package to the well's output.

SIDEROLL EVALUATIONS

One of the objectives of recent sideroll evaluations has been to evaluate the rectangular orifice nozzles (CDS) now being used on center pivot sprinklers under sideroll sprinkler applications. These nozzles attempt to overcome the "doughnut" effect, which usually accompanies running circular orifice nozzles at low pressure, by producing a wide-angle fan discharge from the low-pressure nozzle (Figure 8).

In 1981, the Soil Conservation Service in New Mexico evaluated over 50 sideroll sprinkler systems to evaluate the effectiveness of various low-pressure options on sideroll sprinkler efficiency.

CIRCULAR ORIFICE NOZZLE OPERATING
AT LOW PRESSURE



NON-CIRCULAR ORIFICE NOZZLE OPERATING
AT LOW PRESSURE



FIGURE 8

To perform these sideroll sprinkler comparisons, circular orifice nozzle systems were evaluated by running a lateral at its usual pressure of 40-50 PSI; while, under the same wind and temperature conditions, 30 PSI regulators were installed, and comparison evaluations of various low-pressure nozzles were run on the same lateral as the high-pressure nozzles.

Catch cans were set out on a ten-foot grid spacing, the amount of water caught in each can was measured, and the uniformity of the application computed. The amount of water hitting the ground was compared to the amount of water leaving the nozzle, and the total system efficiency was also computed.

The following is a cross-section of these evaluations and gives trends that were found in these tests:

ESTANCIA

At Estancia, where the well lift was 240 feet, circular orifice nozzles, running at 40-46 PSI nozzle pressure, were compared with rectangular orifice nozzles running at 30 PSI. These tests were performed under daytime sets with low daily wind volumes of 8-42 miles per day.

All tests showed that, under 60-foot lateral moves, the high-pressure nozzles were consistently about 20 percentage points more efficient than the low-pressure rectangular orifice nozzles. This increased efficiency outweighed the extra 10-16 PSI pumping head and made the single, high pressure, circular orifice nozzle more cost-effective than the low-pressure nozzle on 60-foot moves. When the lateral distance was cut to 50-foot

moves, the low-pressure nozzle efficiency rose, but it was still 7-16 percent lower than that of the high-pressure alternative. When used on 50-foot moves and against 240 feet of pumping lift, the low-pressure nozzle was found to be just barely cost-effective. At 240' lift, there was really no cost advantage between the high- and low-pressure systems on 50-foot moves.

An interesting comparison test run at Estancia was between a double, circular orifice nozzle running at 40 PSI and a 1/4-inch single, circular orifice nozzle operating at 30 PSI. Both of these nozzles had the same approximately GPM discharge; but the single nozzle was running well below its recommended pressure range.

On 60-foot moves, the double nozzle had an efficiency of 23 percentage points higher than the low-pressure circular orifice. Even when run on 50-foot moves, the double orifice nozzle run at 40 PSI was still 13 percentage points higher than the 30 PSI single orifice nozzle. These tests showed that at 240 feet of lift, the double nozzle running at 40 PSI, in the 8-10 GPM range, was more cost-effective than the 30 PSI single orifice nozzle, regardless of whether 60- or 50-foot moves were used.

LOVINGTON

Comparison tests were also run at Lovington, where the well lift was only 100 feet, but with much higher wind volumes. These tests were conducted on daytime as well as nighttime sets with wind volumes of

200-450 MPD, or 10 times the daily wind volume of Estancia.

The Lovington tests compared single, circular orifice nozzles operating at 55 PSI with rectangular orifice nozzles running at 30 PSI. Nighttime tests on 60-foot lateral moves showed the circular orifice nozzle at 55 PSI to have a system efficiency of 21 percentage points higher than the rectangular nozzle running at 30 PSI.

Even with the lower pumping lift of 100 feet, the rectangular orifice nozzle was not found to be cost-effective on 60 foot moves. When the lateral moves were cut to 50 foot, the system efficiencies became equal and, thus, the rectangular orifice nozzle became cost-effective. It was felt, however, that if a double nozzle at 40-45 PSI had been used instead of the single nozzle at 55 PSI, the rectangular orifice would not have been cost-effective on 50 foot moves.

One other test at Lovington that deserves mentioning involved the comparison of a circular orifice and rectangular orifice nozzle operating at the same low pressure of 30 PSI. In this test, the circular orifice nozzle was running well below its recommended pressure range. This test was run in the daytime with volumes of 220 miles per day. On 50-foot moves, the rectangular orifice nozzle had an efficiency of 14 percentage points higher than the circular orifice nozzle running at the same low pressure of 30 PSI.

PORTALES-ROSWELL-ARTESIA

A few tests done on systems in Portales, Roswell, and Artesia during 1981 have

also been included in the attached tables. Artesia has had apparent success using 1/4-inch circular orifice nozzles at 30 PSI, but as can be seen from Figures 6 and 7, under very calm wind conditions.

When you compare the total miles per day between all testing locations, you can see why it is important to keep the nozzles in the recommended pressure range, especially as the wind volume increases.

CONCLUSION

Before promoting any low-pressure alternative, whether for center pivot or sideroll sprinkler systems, analyze and compare the performance of the current sprinkler hardware to the available low- and high-pressure alternatives.

Keep in mind the wind and well lift under which the system is currently or will be operating and, after careful analysis of these variables, the SCS can assist the producer decide whether lowering the sprinkler pressure will actually increase profits and save valuable water, labor, and fuel resources.

TABLE 1 - SHEET 1

SUMMARY OF CENTER-PIVOT SPRINKLER EVALUATIONS (Texas)														
EVALUATION				SCS Administra-tive Area (Town)	NOZZLE		Wind Speed (mph)	PIVOT		EFFICIENCY			true Cost \$/ac.-in.	Remarks
No.	Date	Area No.	Location (County)		Type	Loca-tion		Pressure (psi)	Flowrate (gpm)	Pattern (%)	Appli-cation (%)	System (%)		
1	7/7/80	1	Swisher	Amarillo	spray	drop	12	23	480	74	90	67	\$	
2	7/25/80	2	"	"	spray	drop	5	32	500	73	95	70		
3	8/1/80	3	"	"	impact	top	11	70	270	76	60	46		
4	8/5/80	4	"	"	spray	drop	18	11	260	52	69	36		
5	5/13/80	5	"	"	spray	drop	14	30	665	59	85	50		
6	8/13/80	6	"	"	360° spray	drop	13	14	270	56	83	47		
7	6/23/80	7	"	"	impact & spray	top & side	5	30	370	92	95	87		
8	6/27/80	8	"	"	impact	top	12	27	410	69	86	59		
9	7/22/80	9	Briscoe	"	impact	drop	6	36	600	71	89	63		
10	7/8/80	10	"	"	spray	drop	10	26	570	63	88	55		
11	7/31/80	11	"	"	impact	top	10	26	510	94	98	92		
12	8/1/80	12	"	"	impact	top	8	16	470	42	94	39		
13	7/31/80	13	Deaf Smith	"	360° spray	drop	10	36	750	79	62	48		
14	7/10/80	14	"	"	spray	top	10	31	700	75	70	53		
15	7/23/80	15	"	"	spray	drop	3	45	500	71	98	70		
16	5/12/80	16	"	"	impact	drop	25	39	485	53	68	36		
17	6/25/80	17	"	"	spray	top	20	32	490	90	93	84		
18	6/19/80	18	"	"	inverted impact	drop	2	40	640	62	77	42		
19	6/5/80	19	"	"	impact	top	11	56	710	76	79	60		
20	8/28/80	20	"	"	impact	top	20	35	545	70	63	44		
21	9/18/80	21	"	"	spray	top	10	28	600	73	84	61		
22	8/29/80	22	"	"	spray	top	5	28	780	84	59	50		
23	8/6/81	23	"	"	180° spray	drop	10	27	450	75	99	74	2.17	

TABLE 1 - SHEET 2

SUMMARY OF CENTER-PIVOT SPRINKLER EVALUATIONS (Texas)

EVALUATION				SCS Administra- tive Area (Town)	NOZZLE		Wind Speed (mph)	PIVOT		EFFICIENCY			Fuel Cost \$/ac.-in.	Remarks
					Type	Loca- tion		Pressure (psi)	Flowrate (gpm)	Pattern (%)	Appli- cation (%)	System (%)		
26	5/5/81	26	Deaf Smith	Amarillo	impact	top	12	75	420	57	87	49	\$2.22	
27	7/29/80	27	Dallam	"	180° spray	drop	5	26	800	68	72	49		
28	7/29/80	28	"	"	180° spray	drop	10	25	650	59	92	54		
29	7/23/80	29	"	"	180° spray	drop	10	25	700	58	96	56		
30	7/25/80	30	"	"	180° spray	drop	5	28	600	61	94	58		
31	7/25/80	"	"	"	180° spray	drop	5	29	150	55	94	52		
32	7/8/81	32	"	"	180° spray	drop	13	39	1040	68	63	43		
33	4/2/81	33	"	"	180° spray	drop	22	34	650	58	96	55		
34	4/9/81	34	"	"	impact	top	17	60	850	64	95	60		
35	7/16/80	35	Castro	"	impact	top	5	70	600	61	82	50		
36	8/1/80	36	"	"	impact	top	10	45	580	66	85	56		
37	7/14/80	37	"	"	180° spray	drop	6	30	620	63	71	45		
38	5/21/80	38	"	"	impact	top	12	66	725	83	85	71		
38A	6/3/80	38A	"	"	impact	top	3	43	725	80	98	78		
39	5/1/80	39	"	"	impact	top	7	41	725	83	89	74		
40	6/10/80	40	"	"	impact	side	6	41	605	69	97	67		
40A	6/4/81	40A	"	"	impact	side	10	27	622	82	86	71		
41	9/2/80	41	"	"	impact	top	12	45	650	79	81	64		
42	8/27/80	42	"	"	impact	top	12	40	790	79	65	52		
43	7/14/80	43	Parmer	"	impact	top	13	47	715	76	70	53		
44	7/16/80	44	"	"	180° spray	top	15	18	490	59	71	42		
45	7/16/80	45	"	"	impact	top	8	56	860	77	59	45		
46	7/3/80	46	"	"	impact	top	8	35	490	85	76	65		
47	7/17/80	47	"	"	impact	top	10	80	625	70	56	39		
48	6/19/80	48	"	"	impact	top	5	28	450	83	95	78	\$	

TABLE 1 - SHEET 3

SUMMARY OF CENTER-PIVOT SPRINKLER EVALUATIONS (Texas)

EVALUATION				SCS Administra- tive Area (Town)	NOZZLE		Wind Speed (mph)	PIVOT		EFFICIENCY		Fuel Cost: \$/ac.-in.	Remarks
No.	Date	Area No.	Location (County)		Type	Loca- tion		Pressure (psi)	Flowrate (gpm)	Pattern (%)	Appli- cation (%)	System (%)	
49	8/13/80	49	Parmer	Amarillo	180° spray	top	10	24	750	89	95	85	\$
50	8/11/80	50	"	"	impact	top	7	34	540	82	94	77	
51	7/24/80	51	Potter	"	180° spray	drop	12	32	820	63	95	60	
52	7/2/80	52	Carson	"	impact	top	9	61	716	71	70	49	
53	6/30/80	53	"	"	impact	top	13	61	680	70	56	39	
54	8/11/80	54	"	"	180° spray	drop	15	32	960	83	78	65	
55	6/6/80	55	"	"	impact	top	13	68	675	84	96	81	
56	5/14/80	56	"	"	impact	top	13	85	665	74	80	59	
56A	6/10/80	56A	"	"	impact	top	13	40	840	80	85	68	
57	7/7/81	57	"	"	impact	top	15	75	670	72	69	50	
58	7/14/81	58	"	"	impact	top	10	37	510	86	65	56	
59	4/20/81	59	"	"	impact	top	7	40	686	71	78	55	
60	7/18/80	60	Moore	"	180° spray	drop	11	16	995	69	73	50	
61	7/17/80	61	"	"	180° spray	drop	8	26	905	75	79	59	
62	7/30/80	62	"	"	360° spray	drop	15	22	714	75	75	56	
63	7/30/80	63	"	"	impact	top	18	54	657	77	53	41	
64	7/25/80	64	"	"	impact	top	8	56	775	93	93	86	
65	7/10/80	65	"	"	impact	top	6	36	790	82	75	62	
66	7/17/80	66	"	"	impact	top	11	23	583	86	60	52	
67	8/20/80	67	"	"	impact	top	8	24	430	78	83	65	
68	7/31/81	68	"	"	6° impact	top	9	20	476	89	91	81	
69	7/6/81	69	"	"	6° impact	top	5	52	787	80	75	60	
70	7/23/81	70	"	"	6° impact	top	7	25	467	71	59	42	
71	7/7/81	71	"	"	6° impact	top	14	44	947	89	85	76	
72	7/23/80	72	Randall	"	spray	drop	5	40	585	70	78	55	\$

TABLE 1 - SHEET 4

SUMMARY OF CENTER-PIVOT SPRINKLER EVALUATIONS (Texas)														
EVALUATION				SCS Administrative Area (Town)	NOZZLE		Wind Speed (mph)	PIVOT		EFFICIENCY			Fuel Cost \$/ac.-in.	Remarks
No.	Date	Area No.	Location (County)		Type	Loca- tion		Pressure (psi)	Flowrate (gpm)	Pattern (%)	Appli- cation (%)	System (%)		
73	7/8/80	73	Randall	Amarillo	spray	drop	10	30	450	45	99	45	\$	
74	7/14/80	74	"	"	180° spray	drop	20	25	640	53	81	43		
75	10/4/80	75	"	"	impact	top	5	60	675	74	80	59		
76	7/3/80	76	"	"	impact	top	8	57	700	75	100	75		
77	7/7/80	77	"	"	impact	top	11	20	595	70	45	32		
78	7/2/80	78	"	"	impact	top	8	66	510	77	86	66		
79	7/1/81	79	"	"	360° spray	drop	12	25	965	80	63	50		
80	7/24/80	80	Armstrong	"	impact	top	7	37	400	67	84	56		
81	7/22/80	81	Hartley	"	180° spray	drop	5	26	631	65	72	47		
82	7/22/80	82	"	"	180° spray	drop	7	20	695	54	57	31		
83	9/26/80	83	"	"	impact	drop	18	44	660	61	71	43		Impact nozzles inverted
84	8/6/80	84	"	"	180° spray	drop	18	18	430	70	97	68		
85	8/7/80	85	"	"	impact	top	23	53	780	81	97	79		
86	4/8/81	86	"	"	180° spray	drop	8	45	590	65	96	62		
87	8/4/81	87	"	"	impact	top	15	55	700	82	86	71		
88	6/8/81	88	"	"	impact	top	15	44	660	61	71	43		
89	7/6/81	89	"	"	impact	top	3	48	797	89	98	88		
90	7/22/81	90	"	"	impact	top	11	43	734	80	83	66		
91	10/14/81	91	"	"	180° spray	drop	8	23	501	83	76	63		
149A	8/5/81	42-80A	Floyd	Lubbock	360° spray	drop	8	40	1200	86	95	81	2.36	F1-1
152A	8/11/81	50-80A	Hockley	"	Modified spray w/tube & sock	drop	3	55	920	59	100	59	--	Le-17
92	5/14/81	L1-9	Lamb	"	180° spray	drop	4	38	780	68	87	60	1.66	
93	5/28/81	L1-11	"	"	180° spray	drop	7	32	800	75	100	75	1.83	
94	6/1/81	L1-12	"	"	360° spray	drop	8	40	690	80	91	73	3.81	
95	6/8/81	L1-16	"	"	360° spray	top	8	29	920	76	81	61	\$2.04	

TABLE 1 - SHEET 5

SUMMARY OF CENTER-PIVOT SPRINKLER EVALUATIONS (Texas)

EVALUATION				SCS Administra- tive Area (Town)	NOZZLE		Wind Speed (mph)	PIVOT		EFFICIENCY			Fuel Cost \$/ac.-in.	Remarks
No.	Date	Area No.	Location (County)		Type	Loca- tion		Pressure (psi)	Flowrate (gpm)	Pattern (%)	Appli- cation (%)	System (%)		
96	6/9/81	L1-1	Lamb	Lubbock	360° spray	top	10	30	530	85	91	77	\$2.23	
195A	6/4/81	113-80A	"	"	180° spray	drop	8	26	470	81	91	74	3.18	Li-18
97	7/7/81	L1-19	"	"	Modified spray w/tube & sock	drop	8	20	310	84	100	84	2.84	
98	7/2/81	L1-20	"	"	180° spray	drop	10	35	820	75	96	73	2.49	
99	7/9/81	L1-21	"	"	360° spray	top	16	35	630	78	92	72	1.87	
100	7/14/81	L1-23	"	"	360° spray	top	12	30	730	85	96	81	1.67	
188A	7/23/81	11-78 A	Lubbock	"	Modified spray w/tube & sock	drop	12	32	360	76	100	76	--	Lu-1
101	7/24/81	Ma-7	Motley	"	180° spray	drop	15	12	430	65	51	33	--	
102	4/27/81	Mo-1	Cochran	"	360° spray	drop	7	10	300	76	93	73	--	
103	6/22/81	Mo-2	"	"	360° spray	top	10	32	450	87	83	72	--	
194B	4/2/81	17-78B	Bailey	"	Low angle impact	top	15	34	920	83	99	84	--	Mu-1
104	4/1/81	Mu-2	"	"	Low angle impact	top	18	42	800	78	88	69	--	
105	4/8/81	Mu-3	"	"	360° spray	drop	16	32	800	76	87	66	2.72	
196A	5/1/81	18-79A	"	"	Low angle impact	top	3	40	760	80	97	78	2.53	Mu-5
106	5/27/81	Mu-6	"	"	360° spray	drop	9	33	850	86	94	81	2.39	
107	5/1/81	Mu-8	"	"	Low angle impact	top	8	36	720	87	92	80	2.39	
108	5/14/81	Mu-9	"	"	Low angle impact	top	6	43	1,000	89	80	71	1.72	
109	5/28/81	Mu-10	"	"	Low angle impact	top	9	60	975	88	96	85	2.96	
110	5/18/81	Mu-11	"	"	Low angle impact	top	10	66	900	81	84	68	2.61	
111	5/20/81	Mu-12	"	"	360° spray	drop	12	52	760	71	77	55	2.13	w/o corner attachment
111A	5/22/81	Mu-12A	"	"	360° spray	drop	20	38	870	64	77	49	2.01	Mu-13 w/corner attachment
112	6/25/81	Mu-14	"	"	Low angle impact	top	12	40	760	84	93	78	--	
113	6/11/81	Mu-15	"	"	Low angle impact	top	3	64	1,125	62	84	52	2.52	
114	7/22/81	Mu-16	"	"	360° spray	top	13	40	900	82	88	73	2.22	
115	10/2/80	Mu-17	"	"	Low angle impact	top	7	64	1,010	81	83	67	\$ 2.89	

TABLE 1 - SHEET 6

SUMMARY OF CENTER-PIVOT SPRINKLER EVALUATIONS (Texas)														
EVALUATION				SCS Administrative Area (Town)	NOZZLE			PIVOT		EFFICIENCY			Fuel Cost \$/ac.-in.	Remarks
No.	Date	Area No.	Location (County)		Type	Loca- tion	Wind Speed (mph)	Pressure (psi)	Flowrate (gpm)	Pattern (%)	Appli- cation (%)	System (%)		
116	10/2/80	Mu-18	Bailey	Lubbock	Low angle impact	top	18	64	680	82	65	54	\$ 2.53	
117	10/8/80	Mu-19	"	"	Low angle impact	top	4	49	1,125	87	80	70	2.45	
118	10/9/80	Mu-20	"	"	Regular angle impact	top	5	60	1,150	73	90	66	2.44	
119	7/9/81	Mu-23	"	"	Low angle impact	top	.9	65	1,200	75	94	71	2.38	
120	6/24/81	P1-7	Hale	"	Regular angle impact	top	12	46	1,200	73	74	55	--	
121	7/81	P1-15	"	"	360° spray	drop	8	45	840	75	98	73	--	
122	5/21/80	1-80	Lamb	"	180° spray	top	8	30	650	77	90	70	1.32	
123	5/22/80	2-80	"	"	Low angle impact	top	5	38	925	90	97	87	2.08	
124	5/21/80	3-80	"	"	360° spray	top	6	35	650	78	97	76	1.35	
125	5/27/80	4-80	"	"	360° spray	drop	15	32	650	63	86	54	1.13	
126	5/23/80	5-80	"	"	Low angle impact	top	14	43	700	80	90	72	1.63	
127	5/29/80	6-80	"	"	Low angle impact	top	11	46	860	88	92	61	1.91	
128	6/20/80	7-80	"	"	Low angle impact	top	8	48	760	72	84	61	0.98	
129	6/18/80	8-80	"	"	360° spray	top	2	39	735	85	86	74	--	
130	6/17/80	9-80	"	"	360° spray	top	5	40	755	77	97	74	1.39	
131	7/21/80	10-80	"	"	180° spray	top	3	38	850	75	93	70	3.13	
132	6/20/80	11-80	Cochran	"	180° spray	top	10	28	850	64	87	56	2.30	
133	7/3/80	12-80	"	"	Low angle impact	top	3	44	400	67	79	53	--	
134	7/8/80	13-80	"	"	180° spray	drop	8	35	600	43	90	38	--	
135	7/14/80	14-80	"	"	Regular angle impact	top	8	65	600	46	70	32	--	
136	7/17/80	15-80	"	"	Regular angle impact	top	5	64	800	71	93	66	--	
137	7/22/80	16-80	"	"	360° spray	drop	8	35	1,000	78	94	73	--	
138	7/10/80	17-80	Bailey	"	Low angle impact	top	10	60	835	74	88	65	1.81	
139	7/10/80	18-80	"	"	Low angle impact	top	3	60	950	67	58	39	2.37	
140	7/9/80	19-80	"	"	Low angle impact	top	13	43	830	72	95	69	1.62	

TABLE 1 - SHEET 7

SUMMARY OF CENTER-PIVOT SPRINKLER EVALUATIONS (Texas)														
EVALUATION				SCS Administra-tive Area (Town)	NOZZLE			Wind Speed (mph)	PIVOT		EFFICIENCY			Fuel Cost \$/ac-in.
No.	Date	Area No.	Location (County)		Type	Loca-tion	Pressure (psi)		Flowrate (gpm)	Pattern (%)	Appli-cation (%)	System (%)		
141	7/3/80	20-80	Bailey	Lubbock	180° spray	drop	6	24	660	62	89	55	\$1.60	
142	6/23/80	21-80	"	"	Low angle impact	top	7	40	643	60	86	52	3.01	
143	6/26/80	22-80	"	"	Low angle impact	top	14	50	850	69	92	63	1.24	
144	4/10/80	23-80	Hale	"	360° spray	top	12	40	1,150	77	53	41	1.81	
145	4/10/80	24-80	"	"	Regular angle impact	top	7	60	620	69	86	60	2.67	
146	6/19/80	25-80	"	"	Low angle impact	top	5	50	925	78	93	73	--	
147	7/10/80	26-80	"	"	360° spray	top	5	31	800	80	96	77	2.04	
148	7/7/80	27-80	"	"	Regular angle impact	top	12	72	780	89	91	81	2.54	
149	7/22/80	42-80	Floyd	"	360° spray	drop	5	40	1,300	77	92	71	2.17	
150	7/8/80	45-80	Hockley	"	180° spray	drop	8	40	400	79	86	68	1.16	Booster pump only
151	8/4/80	46-80	"	"	Low angle impact	top	5	42	550	84	88	74	2.17	
152	7/14/80	60-80	"	"	Modified spray w/tube and sock	drop	5	39	1,020	87	100	87	2.00	
153	7/22/80	51-80	Lamb	"	180° spray	top	4	25	680	57	77	44	2.33	
154	6/25/80	52-80	"	"	Low angle impact	top	6	44	325	69	93	64	3.09	
155	7/15/80	55-80	Motley	"	Regular angle impact	top	15	33	520	79	82	65	--	
156A	7/21/80	20-79A	Bailey	"	Low angle impact	top	10	48	550	79	78	62	1.45	57-80
156	7/28/80	59-80	Hale	"	180° spray	drop	3	30	860	80	98	78	--	
157	8/28/80	32-80	Floyd	"	180° spray	top	10	29	600	73	89	65	1.92	
158	8/8/80	35-80	Lubbock	"	Low angle impact	drop	5	35	600	80	90	72	2.45	
159	8/5/80	38-80	"	"	360° spray	drop	8	30	200	78	84	50	6.27	
160	8/6/80	39-80	"	"	360° spray	drop	10	20	300	74	85	63	2.31	
161	8/12/80	91-80	Crosby	"	Low angle impact	top	10	54	660	76	91	69	1.10	Booster pump only
162	7/28/80	97-80	Hale	"	180° spray	drop	10	30	850	71	93	66	--	
163	8/14/80	98-80	Cochran	"	Regular angle impact	top	10	65	800	72	93	67	--	
164	8/27/80	112-80	"	"	Low angle impact	top	3	35	700	76	93	71	\$ --	

TABLE 1 - SHEET 8

SUMMARY OF CENTER-PIVOT SPRINKLER EVALUATIONS (Texas)													
EVALUATION				SCS Administra-tive Area (Town)	NOZZLE		Wind Speed (mph)	PIVOT		EFFICIENCY		Fuel Cost \$/ac-in.	Remarks
No.	Date	Area No.	Location (County)		Type	Loca-tion		Pressure (psi)	Flowrate (gpm)	Pattern (%)	Appli-cation (%)		
165	10/22/79	1-79	Bailey	Lubbock	360° spray	drop	10	31	300	78	84	65	\$ --
166	9/27/79	2-79	"	"	180° spray	drop	12	22	685	72	79	57	--
167	9/10/79	3-79	"	"	360° spray	drop	7	29	755	74	73	54	--
168	9/6/79	4-79	"	"	360° spray	drop	2	26	460	78	96	75	--
169	8/20/79	5-79	"	"	Low angle impact	top	6	45	885	82	90	74	--
170A	7/12/79	19-79A	"	"	Low angle impact	top	12	49	850	74	93	68	-- 6-79
170	7/11/79	7-79	"	"	Low angle impact	top	10	40	940	76	83	63	--
177A	7/2/79	15-79A	"	"	Low angle impact	top	7	48	755	76	90	68	-- 8-79
171	6/27/79	9-79	"	"	Low angle impact	top	10	44	730	84	97	82	--
172	6/26/79	10-79	"	"	180° spray	drop	3	40	925	71	80	57	--
173	6/20/79	11-79	Lubbock	"	Regular angle impact	top	3	48	355	61	73	44	--
174	6/15/79	12-79	Bailey	"	100° spray	drop	9	20	675	71	82	50	--
175	6/14/79	13-79	Dickens	"	180° spray	top	8	36	550	63	65	41	--
176	5/22/79	14-79	Cochran	"	180° spray	drop	7	32	590	82	90	73	--
177	4/20/79	15-79	Bailey	"	180° spray	top	9	42	1,050	67	75	50	--
178	4/3/79	16-79	Lubbock	"	Regular angle impact	top	6	55	600	52	89	46	1.52
180A	9/15/78	3-78A	Bailey	"	Low angle impact	top	4	52	770	87	94	82	-- 1-78
179	8/27/78	2-78	"	"	180° spray	top	5	28	510	72	81	58	--
180	8/23/78	3-78	"	"	Low angle impact	top	12	41	650	71	89	63	--
181	8/18/78	4-78	"	"	Low angle impact	top	16	72	820	78	84	66	--
182	8/16/78	5-78	"	"	Regular angle impact	top	20	38	940	57	71	40	--
183	8/9/78	6-78	Crosby	"	Regular angle impact	top	5	37	400	75	98	73	--
184	8/9/78	7-78	Lubbock	"	360° spray	drop	3	19	500	55	98	54	--
185	7/24/78	8-78	Bailey	"	180° spray	top	6	41	850	75	85	64	--
186	7/21/78	9-78	"	"	180° spray	side	8	21	710	35	90	31	\$ --

TABLE 1 - SHEET 9

SUMMARY OF CENTER-PIVOT SPRINKLER EVALUATIONS (Texas)														
EVALUATION				SCS Administra-tive Area (Town)	NOZZLE		Wind Speed (mph)	PIVOT		EFFICIENCY			Fuel Cost \$/ac-in.	Remarks
No.	Date	Area No.	Location (County)		Type	Loca-tion		Pressure (psi)	Flowrate (gpm)	Pattern (%)	Appli-cation (%)	System (%)		
187	7/18/78	10-78	Bailey	Lubbock	180° spray	drop	16	63	485	76	74	56	\$ --	
188	8/9/78	11-78	Lubbock	"	180° spray	drop	3	18	405	60	100	60	--	
189	7/11/78	12-78	Bailey	"	Regular angle impact	top	13	60	800	75	61	46	--	
190	7/7/78	13-78	"	"	180° spray	top	6	55	800	72	86	62	--	
191	6/28/78	14-78	"	"	180° spray	top	9	29	1,000	79	91	71	--	
192	6/27/78	15-78	"	"	Regular angle impact	top	13	60	800	62	64	40	--	
193	6/23/78	16-78	"	"	180° spray	top	9	60	700	69	78	54	--	
194	8/15/78	17-78	"	"	Regular angle impact	top	8	70	770	87	59	51	--	
194A	7/5/79	17-78A	"	"	Low angle impact	top	7	41	870	87	85	73	--	17-79
195	5/13/80	113-80	Lamb	"	180° spray	drop	10	30	550	69	100	69	--	
196	8/14/79	18-79	Bailey	"	180° spray	top	7	27	860	71	76	54	--	
197	6/20/79	19-79	"	"	180° spray	top	9	42	1,020	67	75	50	--	
198	8/16/79	20-79	"	"	360° spray	drop	8	53	550	65	92	59	--	
199	DELETED DUE TO INSUFFICIENT DATA													
200	7/13/79	2	Sherman	"	Impact	top	5	85	750	76	64	48	--	
201	7/13/79	3	"	"	Impact	top	5	85	600	74	59	43	--	
202	7/7/80	4	Hall	"	spray	top	8	34	820	82	74	61	0.60	
203	7/8/80	5	"	"	spray	drop	10	34	870	75	81	61	0.67	
204	7/9/80	6	Donley	"	spray	top	9	40	730	67	72	48	1.38	
205	7/10/80	7	Hansford	"	spray	drop	7	35	960	67	91	60	0.99	
206	8/18/80	8	Gray	"	spray	drop	25	24	880	73	81	59	2.99	Avg. of 3 wells.
207	9/15/80	9	Sherman	"	spray	top	8	27	730	83	77	64	--	
208	9/16/80	10	"	"	spray	top	8	29	850	86	76	64	--	
209	9/23/80	11	Hansford	"	impact	top	12	65	510	69	61	42	\$ --	

TABLE 1 - SHEET 10

SUMMARY OF CENTER-PIVOT SPRINKLER EVALUATIONS (Texas)

No.	Date	EVALUATION		SCS Administra-tive Area (Town)	NOZZLE		Wind Speed (mph)	PIVOT		EFFICIENCY			Fuel Cost \$/ac-in.	Remarks
		Area No.	Location (County)		Type	Loca-tion		Pressure (psi)	Flowrate (gpm)	Pattern (%)	Appli-cation (%)	System (%)		
210	9/15/80	12	Sherman	Pampa	spray	drop	15	27	730	83	77	64	\$ --	
211	9/16/80	13	"	"	spray	drop	15	29	850	86	76	64	--	
212	10/3/80	14	"	"	spray	drop	4	42	715	63	95	60	--	
213	DELETED DUE TO INSUFFICIENT DATA													
214	10/2/80	16	"	"	360° spray	drop	5	40	679	57	93	53	--	
215	10/14/80	17	"	"	spray	drop	3	30	485	72	86	62	--	
216	DELETED DUE TO INSUFFICIENT DATA													
217	DELETED DUE TO INSUFFICIENT DATA													
218	6/5/81	20	"	"	spray	drop	12	46	750	88	94	83	--	
219	DELETED DUE TO INSUFFICIENT DATA													
220	6/24/81	22	Roberts	"	High Pressure impact	top	15	85	720	71	74	53	--	
221	6/25/81	23	"	"	spray	top	6	66	900	72	79	57	--	
222	DELETED DUE TO INSUFFICIENT DATA													
223	DELETED DUE TO INSUFFICIENT DATA													
224	7/30/81	1	Knox	Vernon	360° spray	drop	4-6	60	1,190	76	55	42	1.29	
225	8/21/81	2	"	"	360° spray	drop	1	10	120	67	75	50	3.63	
226	7/9/81	3	"	"	360° spray	drop	5-8	38	570	64	99	63	1.90	
227	8/13/81	4	"	"	360° spray	drop	10-20	35	435	75	84	63	1.70	
224A	9/1/81	1-A	"	"	Low angle impact	drop	5-7	55	1,100	87	89	77	1.58	
228	5/13/81	5	"	"	360° spray	drop	12-15	5	190	32	69	22	1.44	
229	8/13/69	1	Zavala	Uvalde	360° impact	top	10	71	747	78	81	62	1/	System checked prior to current IWM program
230	11/20/80	2	Uvalde	"	360° impact	top	3	62	940	70	73	51	2.19	
231	4/8/81	3	"	"	360° impact	top	6	70	859	69	92	63	1/	
232	5/20/81	5	Medina	"	180° spray	top	10	52	1,350	72	90	65	1/	
233	6/9/81	6	Uvalde	"	360° spray	top	4	38	1,410	94	93	87	\$ 1.72	

TABLE 1 - SHEET 11

SUMMARY OF CENTER-PIVOT SPRINKLER EVALUATIONS (Texas)														
EVALUATION				SCS Administra- tive Area (Town)	NOZZLE		Wind Speed (mph)	PIVOT		EFFICIENCY			Fuel Cost \$/ac.-in.	Remarks
No.	Date	Area No.	Location (County)		Type	Loca- tion		Pressure (psi)	Flowrate (gpm)	Pattern (%)	Appli- cation (%)	System (%)		
234	7/10/81	7	Uvalde	Uvalde	360° spray	top	1	44	900	69	74	51	\$3.75	
235	7/15/81	8	Medina	"	360° spray	drop	9	50	999	75	70	53	1/	
236	7/22/81	10	Zavala	"	360° impact	top	6	46	1,190	80	84	67	1/	
237	7/23/81	11	"	"	360° impact	top	4	82	1,135	55	70	39	1/	
238	8/11/81	12	Uvalde	"	360° spray	top	5	72	1,120	68	90	61	2.99	
239	8/25/81	13	Medina	"	180° spray	top	7	35	999	73	88	64	1/	
240	7/8/81	B-1	Terry	Big Spring	360° spray	drop	8	30	450	81	95	77	--	
241	7/17/81	B-2	"	"	360° spray	drop	10	25	510	75	82	62	--	
242	7/16/81	B-3	"	"	360° spray	drop	7	26	535	77	89	68	--	
243	4/13/81	B-4	"	"	180° spray	drop	10	35	1,040	77	57	44	--	
244	8/7/81	B-5	"	"	360° spray	drop	5	28	545	78	79	62	--	
245	7/28/81	B-6	"	"	impact	top	8	55	520	82	96	79	--	
246	6/14/81	B-7	"	"	impact	top	10	54	500	82	94	77	--	
247	6/29/81	B-8	"	"	impact	top	5	40	840	60	76	46	--	
248	8/10/81	B-9	"	"	180° spray	drop	7	28	445	75	87	65	--	
249	7/24/81	B-10	"	"	impact	top	6	55	830	85	63	54	--	
250	7/20/81	P-1	Yoakum	"	Low angle impact	top	8	63	820	73	97	71	--	
251	7/22/81	P-2	"	"	Low angle impact	top	8	38	560	73	82	60	--	
252	7/23/81	P-3	"	"	Low angle impact	top	9	70	980	78	98	76	--	
253	7/23/81	P-4	"	"	Low angle impact	top	8	58	450	74	64	47	--	
254	7/28/81	P-5	"	"	Low angle impact	top	7	37	810	82	97	80	--	
255	7/28/81	P-6	"	"	Low angle impact	top	7	60	1,050	85	95	81	--	
256	7/30/81	P-7	"	"	Low angle impact	top	0	68	680	88	96	84	--	
257	8/5/81	P-8	"	"	180° spray	drop	5	58	980	50	67	34	--	
258	8/7/81	P-9	"	"	360° spray	drop	6	25	430	67	98	66	1--	

TABLE 1 - SHEET 12

SUMMARY OF CENTER-PIVOT SPRINKLER EVALUATIONS (Texas)

EVALUATION				SCS Administra- tive Area (Town)	NOZZLE		Wind Speed (mph)	PIVOT		EFFICIENCY			Fuel Cost \$/ac-in.	Remarks
No.	Date	Area No.	Location (County)		Type	Loca- tion		Pressure (psi)	Flowrate (gpm)	Pattern (%)	Appli- cation (%)	System (%)		
259	1/29/81	P-10	Yoakum	Big Spring	Low angle impact	top	8	50	720	72	62	37	--	
260	5/19/81	S-1	Gaines	"	360° spray	drop	8	19	660	72	75	54	--	
261	5/19/81	S-2	"	"	360° spray	drop	8	30	890	84	45	38	--	
262	5/26/81	S-3	"	"	360° spray	drop	1	17	700	79	77	61	--	
263	5/26/81	S-4	"	"	360° spray	drop	7	14	422	65	72	47	--	
264	5/28/81	S-5	"	"	360° spray	drop	7	16	630	64	91	58	--	
265	6/17/81	S-6	"	"	360° spray	drop	7	34	762	73	88	64	--	
266	6/18/81	S-7	"	"	360° spray	drop	14	24	1,225	84	78	66	--	
267	6/30/81	S-8	"	"	360° spray	drop	8	20	750	73	74	54	--	
268	7/6/81	S-9	"	"	360° spray	drop	4	25	450	84	65	55	--	
269	7/14/81	S-10	"	"	360° spray	drop	9	17	470	73	91	66	--	

1/ Power and pumping units not evaluated--no value for fuel cost \$/ac in.

NOTE: Designation A, B, etc., following an evaluation number is the first (A) reevaluation, second (B) reevaluation, etc., of the same number system evaluation after the system was reworked.

CENTER PIVOT EVALUATIONS

IN NEW MEXICO - 1979

TABLE 2

Location	Nozzle Type	Pivot Pressure PSI	Wind MPH		Pattern %	EFFICIENCY		
						Application %	System %	
Lovington	Spray	20	0- 5		54	91	49	
Lovington	L.A. Impact	55	7		84	88	74	
Lovington	Spray	45	10		69	47	37	
Lovington	Spray	30	3- 5		73	90	68	
Portales	Impact	55	10-20		78	--	--	
Portales	Impact	58	0- 5		87	--	--	
Portales	Spray		0- 5		81	--	--	
Portales	Impact	60	0- 5		79	--	--	
Portales	Impact		5-10		74	--	--	
Portales	Spray	25	15		77	--	--	
Portales	Spray	25	10-15		76	--	--	
Portales	Spray	25			58	--	--	
Artesia	Spray	25	3- 5		59	--	--	
Clayton	Spray	52			93	--	--	
Estancia	Impact	63	3		51	--	--	

LA = Low Angle Impact

LA = Low Angle Impact

CENTER PIVOT EVALUATIONS

IN NEW MEXICO - 1980

TABLE 3

LOCATION	NOZZLE TYPE	PIVOT PRESSURE PSI	WIND MPH		EFFICIENCY			
					PATTERN %	APPLICA- TION %	SYSTEM %	
Clayton	180° Spray	35	0		74	90(F)	67	
Clayton	180° Spray	52	10		93	90(F)	84	
Clayton	Impact	35	3-8		67	82	55	
Clovis	360° Spray	45	0-8		76	84	64	
Roswell	180° Spray	25	2-4		50	88	44	
Artesia	360° Spray	11	5-10		62	84	52	
Artesia	360° Spray	19	4-8		58	86	50	
Portales	Spray	30	--		74	--	--	
Portales	360° Spray	25	--		77	--	--	
Portales	Impact	34	--		82	--	--	
L.A.	Impact	24	--		77	--	--	
L.A.	Impact	50	--		78	--	--	
L.A.	Impact	58	--		87	--	--	
PortalesImpact	40	25			75	--	--	
PortalesImpact	40	--			76	91	69	
PortalesImpact	40	--			81	--	--	
PortalesImpact	45	5			78	88	69	
PortalesImpact	75	--			82	--	--	
PortalesSpray	20	--			86	--	--	
PortalesImpact	50	--			74	--	--	
PortalesImpact	60	--			79	--	--	
PortalesImpact	51	0-2			85	85	72	
Portales Spray	25	0-5			82	86	71	
Alamo- Cordo	360° Spray	20	--		73	88	64	
Alamo- Cordo	180° Spray	18	0-5		80	92	74	
Alamo- Cordo	Impact	42	0-5		75	93	70	
Nicum- Cari	spray	30	4		63	65	41	
Nicum- Cari	spray	30	10-25		62	93	57	
Nicum- Cari	spray	30	8		75	66	50	
Nicum- Cari	spray	20	20-25		68	82	56	
Nicum- Cari	spray	20	5-10		56	76	43	
Loving- ton	L.A. Impact	21	5-7		60	94	56	
Loving- ton	L.A. Impact	32	7-9		85	91	77	
Loving- ton	L.A. Impact	34	0-3		68	93	63	
Loving- ton	L.A. Impact	35	1-3		78	91	72	
Loving- ton	L.A. Impact	36	5-7		79	95	75	
Loving- ton	spray	36	6		72	84	61	
Loving- ton	L.A. Impact	60	0-3		83	82	68	
Artesia	360° Spray	17	4		64	90	58	
Artesia	360° Spray	23	7-12		66	49	32	
Artesia	360° Spray	26	0-5		77	77	59	
Artesia	360° Spray	32	0-4		74	85	63	
Artesia	360° Spray	22	5-7		57	70	40	
Artesia	360° Spray	22			80	94	75	

L.A. = Low Angle

R.A. = Regular Angle

CENTER PIVOT EVALUATIONS

IN NEW MEXICO - 1981

TABLE 4

SIDEROLL SPRINKLER TESTS - 1981

LOVINGTON, NM - 100' LIET

- CIRCULAR ORIFICE

TABLE 5 - SHEET 2

C = RECTANGULAR ORIFICE

SIDEROLL SPRINKLER TESTS - 1981

ESTANCIA, NEW MEXICO

- CIRCULAR ORIFICE

TABLE 5 - SHEET 1

□ - RECTANGULAR ORIFICE

Location	Date	Time of Test	Nozzle Size	Nozzle Pressure PSI	Nozzle Type	Head Type	Wind Speed MPH	Wind Volume MPD	Sprinkler Spacing	Well Lift	Pattern Effic. % (P)	Approx. Effic. % (A)	Total System Effic. % (P x A)			REMARKS
Estancia	6/22/81	9:15 AM 8:48 PM	3/16	46	○	27°	5-9	18	40 x 60	240'	83	75	62	Clovis Wind-527 MPD Artesia Wind-9MPD		
Estancia	6/22/81	2:55 PM	3/16	46	○	27°	5-9	18	40 x 50	240'	83	75	62			
Estancia	6/22/81	9:15 AM 2:55 PM	3/16	30	□	27°	5-9	18	40 x 60	240'	61	71	43	60' Move too far		
Estancia	6/22/81	9:22 AM 2:55 PM	3/16	30	□	27°	5-9	18	40 x 50	240'	78	71	55	Barely cost effective		
Estancia	6/23/81	8:42 AM 2:52 PM	3/16	43	○	27°	0-10	42	40 x 60	240'	81	81	66	Clovis Wind-247MPD Artesia Wind-15MPD		
Estancia	6/23/81	8:42 AM 2:52 PM	3/16	43	○	27°	0-10	42	40 x 50	240'	81	81	66			
Estancia	6/23/81	9:40 AM 2:40 PM	3/16	30	□	17°	0-10	42	40 x 60	240'	68	84	57	60' Move too far		
Estancia	6/23/81	9:42 AM 2:52 PM	3/16	30	□	17°	0-10	42	40 x 50	240'	71	84	60	Barely cost effective		
Estancia	6/29/81	9:40 AM 2:00 PM	3/16	43	○	17°	Gusty 0-25	12	40 x 60	240'	79	90	71	Clovis Wind-661MPD Artesia Wind-16MPD		
Estancia	6/29/81	9:40 AM 2:00 PM	3/16	43	○	17°	Gusty 0-25	12	40 x 50	240'	85	90	77			
Estancia	8/25/81	9:24 AM 3:21 PM	3/16x1/8	40	○	27°	0-7	8	40 x 60	240'	93	85	79	Artesia Wind-6MPD Clovis Wind-134MPD		
Estancia	8/25/81	9:24 AM 3:21 PM	3/16x1/8	40	○	27°	0-7	8	40 x 50	240'	87	85	74			
Estancia	8/25/81	9:31 AM 3:21 PM	3/16	30	□	27°	0-7	8	40 x 60	240'	68	84	57	-60' Move to far		
Estancia	8/25/81	9:31 AM 3:21 PM	3/16	30	□	27°	0-7	8	40 x 50	240'	75	84	63	-Not cost effective		
Estancia	8/26/81	8:40 AM 3:45 PM	3/16x1/8	40	○	27°	0-5Gusts 10-15	11	40 x 60	240'	91	86	78	Artesia Wind-7MPD Clovis Wind-7MPD		
Estancia	8/26/81	8:40 AM 3:45 PM	3/16x1/8	40	○	27°	0-5Gusts 10-15	11	40 x 50	240'	90	86	77			
Estancia	8/26/81	8:50 AM 3:45 PM	1/4	30	○	27°	0-5Gusts 10-15	11	40 x 60	240'	65	85	55	-Not cost effective		
Estancia	8/26/81	8:50 AM 3:45 PM	1/4	30	○	27°	0-5Gusts 10-15	11	40 x 50	240'	75	85	64	-Not cost effective		

SIDEROLL SPRINKLER TESTS - 1981

- CIRCULAR ORIFICE

TABLE 5 - SHEET 3

Location	Date	Time of Test	Nozzle Size	Nozzle Pressure PSI	Nozzle Type	Head Type	Well Lift Feet		Wind Speed MPH	Wind Volume MPD	Sprinkler Spacing	Pattern Effic. %	Approx. Effic. %	System Effic. %	Wind at Other Location MPD	REMARKS
Portales	5/6	12:14 PM 4:37 PM	1/4x3/16	45	(C)	RB 30W	100'		5-20	231	40 x 60	74	85	63	Artesia 15 Estancia 28 Roswell 47	
Roswell	5/4	11:40 AM 3:35 PM	3/16x1/8	35	(C)	Royal Coach	160-200		12-16	53	40 x 40	74	87	64	Artesia 15 Estancia 39 Clovis 750	
Roswell	5/4-5/5	7:50 PM 6:50 PM	3/16x1/8	44	(C)	Royal Coach	160-200		3-8	53-62	40 x 60	81	94	76	Artesia 15-20 Estancia 39-40 Clovis 750-188	Night Set
Roswell	5/4	1:33 PM 7:30 PM	3/16x1/8	44	(C)	Royal Coach	160-200		6-8	53	40 x 60	85	93	79	Same as Above	
Roswell	6/9	2:27 PM 6:15 PM	3/16x1/8	37	(C)	RB 30W	160-200		4-7	42	40 x 60	67	81	54	Artesia 8 Estancia 34 Clovis 270	Pressure too low
Roswell	9/22	9:55 AM 1:00 PM	1/4x1/8	43	(C)	RB 30W	160-200		4	27	40 x 60	90	87	78	Artesia 7 Clovis 115 Estancia 7	

SIDEROLL SPRINKLER TESTS - 1981

VARIOUS LOCATIONS - NEW MEXICO

① - CIRCULAR ORIFICE

TABLE 5 - SHEET 4

Location	Date	Time of Test	Nozzle Size	Nozzle Pressure, PSI	Nozzle Type	Head Type		Wind Speed MPH	Wind Volume MPD	Sprinkler Spacing		Pattern Effic. %	Approx. Effic. %	System Effic. %	Wind MPD at Other Location	REMARKS
Artesia	5/6-5/7	5:45 PM 5:20 AM	1/4	34	(1)	---		0-7	15-20	40 x 60		77	97	75	Clovis 239-288 Estancia 28-37 Roswell 47-87	Night Set
Artesia	5/6	11:00AM 4:30PM	7/32	32	(1)	Senn.		0-7	15	40 x 60		73	85	62	Clovis 239 Estancia 28 Roswell 47	Day Set
Artesia	5/7-5/8	2:20 PM 6:30 AM	1/4	34	(1)	Senn.		5-7	22-16	40 x 60		62	90	56	Clovis 288-206 Estancia 37-47 Roswell 87-26	Overnight
Artesia	5/7	10:45AM 6:30PM	1/4	28	(1)	Senn.		0-7	22	40 x 60		79	87	69	See Above Day Set	
	5/7-5/8	7:35PM 8:35AM	1/4	31	(1)	Senn.		Calm	22-16	40 x 60		77	91	70		Night Set
	5/7-5/8	10:45AM 6:35AM	1/4	28-31	(1)	Senn.		0-7	22-16	40 x 60		78	90	70		Day & Night
Artesia	6/10	11:25 AM 7:30 PM	1/4	30	(1)	RB 30W		7-14	8	40 x 60		75	86	65	Clovis 157-159 Estancia 23-19	Day Set
	6/10-6/1	8:00 7:00 AM	1/4	30		RB 30W		3-5	8-12	40 x 60		81	93	75		Night Set
	6/10-6/1	11:25 AM 7:00 AM	1/4	30		RB 30W		3-14	8-12	40 x 60		81	90	73	Roswell 42-33	Day & Night
Artesia	6/10	10:24 AM 7:01 PM	1/4	30	(1)	RB 30W		7-14	8	40 x 60		76	84	64	See Above Day Set	
	6/10-6/1	7:00 AM	1/4	30	(1)	RB 30W		3-8	8-12	40 x 60		80	94	75		Night Set
	6/10-6/1	10:24 AM 7:00 AM	1/4	30	(1)	RB 30W		3-14	8-12	40 x 60		80	90	72		Day & Night